



Disruptive Potential of 3D Printing for Clothing and Textile Sector

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The Maker Movement, also called the next industrial revolution, has been propelled by the rapid adoption of 3D printing (Anderson, 2012; Brown, 2015). 3D printing, in particular, has the potential to disrupt the Clothing & Textile (C & T) industry (Sun & Lu, 2016) and is challenging the fashion discipline to rethink its supply chain strategies. The concept of disruptive innovation, formulated by Clayton Christensen, was used as a theoretical framework. Disruptive innovations are technologies, which drastically change the lifecycle of products and eventually take over the role of the original product (Christensen, 1997). Previously, C&T researchers have noted the lack of 3D printed apparel (Sun & Lu, 2015; Sun & Parsons, 2014). This research used a qualitative approach to explore whether 3D printing for apparel is a fad or reality. Academicians in the C&T discipline were interviewed to explore the impact of 3D printing as an emerging, and potentially disruptive, technology for C&T to understand the viability of 3D printing for this field.

This study used a grounded theory qualitative research approach to explore the topic. After the approval of Institution Review Board, ten academicians in C&T were interviewed through a semi-structured interview process, conducted via phone or Skype, audio recorded, and transcribed. The research participants represented seven universities across the United States and varied in their roles such as department head, professors, associate/assistant professors, and instructors.

Four major themes of the disruptive influence of 3D printing on C&T emerged. According to the interviewees, 3D printing has the potential to change C&T by 1) streamlining the apparel supply chain; 2) making apparel production sustainable; 3) bring manufacturing to the U.S., and 4) empowering consumers to create their designs. In the first theme, the researchers found that rapid information flow in the product development stage may streamline the supply chain. As one interviewee elaborates, "rapid construction, rapid learning, and rapid prototyping were not possible until this recent revolution regarding manufacturing" and these changes "might shrink the supply chain by rapid information flow in the product development stage." Because of the streamlined supply chain, 3D printing may also improve sustainability. An associate professor with more than thirty years of experience of using technology in C&T believes that "if new technology can be implemented well, it can be disruptive, [designers] will find new ways of construction methods, new distribution methods, new design methods... it will also have an impact on the sustainability of the whole system." Interviewees also saw the potential of bringing manufacturing back to the U.S through high technologies like 3D printing. These emerging technologies "open up an entirely new avenue for [designers], things they have not thought about before, the idea of mass customization, possibility of bringing manufacturing back to the U.S. by implementing high a tech method can be now possible." The final theme was the idea that 3D printing will enable consumers

to design and manufacture artifacts, bypassing the designer: “like the Makers Movement, 3D printing is going to empower people to play around with new types of design and interface and as a result bespoke designing will emerge.”

The researchers also asked interviewees about specific activities which need to take place before we can fully integrate 3D printing in C&T. Their responses addressed: 1) exposure to the technology; 2) teaching 3D software and 3D modeling; 3) collaboration with other fields with more experience in the technology, and 4) fundamentally thinking about ways to seamlessly integrate technology in clothing. Many interviewees felt that the usage of 3D printing for rapid prototyping clothing items is not yet well developed and solidified “therefore students should be experimenting around and see what we can come up with.” According to one interviewee, “having 3D printers available to students is good, but it is not efficient, we need to make the students use the machines themselves, they need to learn how to load the file, they need to monitor the machine.” To help with the integration of 3D printing in C&T, scholars and students “need to look across campus, and take inspiration from other disciplines and work collaboratively.” According to an assistant professor, “if we get over the hurdle of actually being able to produce the fundamental structures of clothing with 3D printers, we can print a textile that has properties that are otherwise impossible, being able to modify the fundamental characteristic of fibers can be revolutionary.”

The qualitative data collected in this research supports the conceptual framework developed by Sun and Lu (2015) for integration of 3D printing in C& T discipline. The results of this study provide C&T discipline with both an understanding of the potential of 3D printing and practical steps to integrating 3D printing for C&T. Eight interviewees agreed that the rapid influence of technology on fashion discipline has the potential to create another “paradigm shift” for C&T. If the emerging technology has the potential of disrupting the way C&T industry functions, the discipline which trains the workforce should be aware of the possible changes and have the ability to transform itself to the new needs of the discipline. Further research must be made to quantitatively analyze the finding of this study, which will help in shaping the analysis of evolution of C&T discipline in this digital age.

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